PCB Fabrication Specification

Rev	Change Description	Changed By	Release Date	Effective Date
A	Initial Release	S. Babiuch	8/25/2016	8/29/2016
B	Changes throughout	S. Babiuch	9/9/2016	9/9/2016
C	Major Overhaul of NT404	Derek Schurman	1/28/2019	1/28/2019

Approvals:

Signature on file 1/28/19

Derek Schurman Date
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VP of Quality Systems and Continuous Improvement

1.0 PURPOSE

This specification establishes the NeoTech fabrication requirements for printed circuit boards. This specification applies to all Printed Circuit Boards procured by Neo Tech.

1.1 To provide NEOTech suppliers with the standard quality and fabrication requirements unless otherwise noted.

1.2 To standardize NEOTech requirements across the entire company.

2.0 SCOPE

Unless otherwise documented on purchase order or defined in documentation found in section, 3.0 ORDER OR PRECEDENCE, Printed Circuit Boards procured by NEOTech will be in accordance with, Purchase Order Quality Clause (NT104, latest revision) and PCB Fabrications specification (this document). This document supplements terms and conditions of the purchase order. If no document revision has been listed, the latest revision of all specifications shall apply. Any deviation to this specification, without written approval from NEOTech are prohibited. Specific and approved deviation apply to a specific purchased part and does not constitute an amendment to the set forth specifications entirely.

3.0 ORDER OF PRECEDENCE

Principal flow down order of precedence, acceptance, fabrication and specification shall apply in the following order:

3.1 NEOTech Purchase Order

3.2 Released Design Files and Fabrication Data / Drawing. This includes but not limited to, supporting procurement documentation, NEOTech and end customer engineering question, NEOTech Array Drawing, and text/readme files.

3.3 NEOTech Customer Specifications

3.4 NEOTech, PCB Fabrication Specification (this document)

3.5 All applicable IPC Standards

4.0 DEFINITIONS

BUYER NEOTech companies and subsidiaries
SELLER NEOTech supplier
PO Purchase Order
PCB Printed Circuit Board
UL Underwriter's Laboratories, Inc.
IPC Association Connecting Electronics Industries

5.0 REFERENCE DOCUMENTS

The following documentation shall be the minimum referenced standard in the fabrications of NEOTech PCB Procurements.

IPC-A-600	Acceptability of Printed Boards
IPC-6011	Generic Performance Specification for Printed Boards
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards
IPC-6013	Qualification and Performance Specification for Rigid-Flex and Flex Printed Circuit Boards
IPC-6016	Qualification and Performance Specification for High Density Interconnect (HDI) Layers and Boards
IPC-6018	Qualification and Performance Specification for High Frequency (Microwave) Printed Boards
IPC-4101	Laminate/Prepreg Materials Standards for Printed Boards
IPC-4552	Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Circuit Boards
IPC-4553	Specification for Immersion Silver Plating for Printed Circuit Boards
IPC-4554	Specification for Immersion Tin Plating for Printed Circuit Boards
IPC-SM-840	Qualification and Performance of Permanent Polymer Coating (Solder Mask) for Printed Boards
IPC-1601	Printed Board Handling and Storage Guidelines
IPC-9252	Guidelines and Requirements for Electrical Testing of Unpopulated Printed Boards
IPC-2615	Printed Board Dimensions and Tolerance
IPC-TM-650	Test Methods Manual
J-STD-003	Solderability Test for Printed Boards
UL STD 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

6.0 ROLES AND RESPONSIBILITIES

6.1 SELLER (Supplier/Manufacture)

6.1.1 SELLER shall inform BUYER if there are any unresolved discrepancies between the BUYER purchase order, BUYER customer information and the BUYER specifications.

6.1.2 SELLER shall obtain latest revision and review all BUYER and CUSTOMER supporting documentation, fabrication information, applicable specifications, referenced on BUYER procurement documentation.

6.1.3 Design documentation provided by BUYER shall be considered confidential information and shall not be disclosed to third parties without BUYER prior written permission.

6.2 BUYER (NEOTech)

6.2.1 Corporate PCB Commodity Management shall maintain this document and assure that the BUYER website has the latest revision.

7.0 PROCEDURE AND FABRICATION REQUIREMENTS

Unless designated by BUYER (Section 3.0), all products are to be built to the following minimum standards; Procurement documentation and specifications, applicable IPC Qualification and Performance Specification (Section 5.0), Class 2 (latest revision), and the requirements in Section 7.0, whichever is more stringent. Any deviations to this specification, without written approval from BUYER, are strictly prohibited. Exceptions to this specification must be obtained in writing from BUYER on an individual part number basis.

7.1 Artwork and Fabrication Drawing Requirements

7.1.1 FABRICATION DATA for a first time purchase or new revision, BUYER shall provide to SELLER the most recent customer fabrication data which shall include at minimum Gerber files. If the customer data includes both ODB++ and Gerber data, and SELLER chooses to use the ODB++ data for fabrication, SELLER must compare the two data files. If there are discrepancies between the data files, it must be reported to BUYER and approval obtained before using the ODB++ data for fabrication. At no time shall SELLER use ODB++ format data for fabrication without comparing to Gerber format data.

7.1.2 Other than standard manufacturing allowances for produceability, there shall be no modifications of the master artwork or Gerber data, or change in material specifications, without prior authorization from BUYER Engineering. All deviations to the fabrication drawing(s) or array drawing(s) must be approved by BUYER.

7.1.3 The SELLER is responsible for verifying that master artwork and/or Gerber data revision levels are in accordance with the master drawings and BUYER purchase order. If there are any discrepancies, BUYER shall be notified for resolution.

7.1.4 The fiducial diameter on the finished PCB must be within ± 0.002” of the original artwork/Gerber data.

7.1.5 All SELLER engineering questions on new PNs shall contain the stack-up for that Part Number. At a minimum, a stack-up shall show copper weights and thicknesses, material types, dielectric thicknesses, plies and types of prepreg used.

7.2 Array Requirements

7.2.1 X-outs (rejected pieces within the array) are not permitted unless indicated on BUYER procurement documentation, BUYER array drawing, or with written authorization from BUYER prior to shipment.

7.2.2 When X-outs boards are permitted, the following shall apply unless otherwise noted:

7.2.2.1 X-out boards must be identified by using a permanent black wide tip marker on both sides of the PCB or other identification method agreed to with BUYER engineering (in writing). The marking method used must withstand the entire assembly process and remain identifiable throughout.

7.2.2.2 The maximum # of X-outs per array is 10% or 1, whichever is greater. The maximum amount of X-out arrays per shipment is 10%. All X-outs boards must be packaged and labeled separately from the acceptable product.

7.3 Dimensional Requirements

7.3.1 Unless otherwise noted, tolerance .xx ± 0.01", .xxx ± 0.005”.

7.3.2 Board tooling hole locations to be ± 0.003" repeatable from board to board for automatic insertion. These tooling holes shall be drilled with the same program as the component holes. Tooling holes shall not be plated.

7.3.3 Bow and Twist must not exceed 0.75%. Measurement shall be in accordance with IPC-TM-650 2.4.22.

7.4 Edge Connector Requirements

7.4.1 Chamfered edge shall have no separation of plating and no loose metal or fibers on the beveled edge.

7.4.2 Unless otherwise specified, keying slots shall be centralized between printed connector contacts within BUYER's fabrication drawing tolerance.

7.5 Plating Requirements

7.5.1 All plating requirements to meet IPC-6012 OR IPC-6013 Class 2 (most current revision).

7.5.2 Plating thieving patterns are allowed within the borders of the BUYER array rails or frames, provided the plated area is copper and then covered with solder mask material. Plating thieving patterns shall be a minimum 0.200” from any fiducial or feature on the array. There shall be no plating thieving patterns within the area of the PCB without BUYER customer approval.

7.6 Solder Mask Requirements

7.6.1 Solder masking must meet the acceptability requirements of IPC-SM-840 (Class 2) and IPC-A-600 (latest revisions) and be of the type specified on customer documentation.

7.6.2 No peeling, flaking, or blistering of the solder mask is allowed upon visual inspection or IPC tape testing (IPC Test Method IPC-TM-650 2.4.1).

7.6.3 Solder Mask shall withstand assembly and wash processes, and be compatible with all flux types (rosin based flux, no clean flux, and water soluble flux).

7.6.4 Via Plugging Height Shall be no greater than 0.003” above via pad.

7.7 Silkscreen Requirements

7.7.1 Silkscreen shall be non-conductive and of contrasting color when not specified on procurement documentation. Silkscreen ink shall be cleared from solderable features.

7.8 Electrical Testing

7.8.1 SELLER shall perform Net List testing on 100% of the boards per IPC Specification 9252 (latest revision). Mark each board image to signify passing electrical tests.

7.8.2 Impedance Testing Requirements: If an impedance requirement is identified on the drawing / specification, SELLER of the PCB shall perform impedance testing of either PCBs or impedance coupons fabricated on the same working panels as the PCBs for each date code. Impedance coupons shall be traceable to the date code shipped.

7.9 Rework and Repair

7.9.1 Repairs or Welding traces is not allowed without written approval from BUYER.

7.9.2 Rework is permitted in accordance with applicable IPC standards as long as the rework does not result in damage or violate dimensional requirements.

7.10 Markings

7.10.1 At minimum, SELLER to permanently mark date code with WWYY format, where WW is week and YY is year. Each board/array shall identify MANUFACTURER’s U.L. code designation on each individual board that will remain legible through assembly and cleaning processes.

7.10.2 All boards, including boards fabricated in a multiple up array must be individually numbered, either in copper or silkscreen on the top side of the board.

7.11 Surface Finish Requirements

7.11.1 **SELLER Surface Finish Shelf Life: OSP, Immersion Silver, Immersion Tin** surface finish more than **three (3) months** old per date code shall be submitted to BUYER for approval prior to shipment. Surface finish exceeding three months shall be submitted to BUYER for approval prior to shipment. Submittal of solderability test data and solder float test data shall be included with submittal and prior to acceptance. BUYER written approval is required and test data shall be included with the shipment.

7.11.2 **SELLER Surface Finish Shelf Life: Hot Air Solder Level** (HASL), **Lead-Free HAL** (LF-HAL) or **Gold** (ENIG) Surface finish shall not be more than **six (6) months** old per date code. Surface finish exceeding six months shall be submitted to BUYER for approval prior to shipment. Submittal of solderability test data and solder float test data shall be included with submittal and prior to acceptance. BUYER written approval is required and test data shall be included with the shipment.

7.11.3 **BUYER Facility Shelf Life Requirements**

At Buyer Facility, when stored in a controlled environment and in original packaging, surface finish shelf life requirements based on lot date code shall not exceed the following shelf life without BUYER engineering approval:

6 months ....OSP, Immersion Silver, Immersion Tin
12 months ....HASL
12 months ....LF-HAL
12 months ....ENIG
12 months ....Electrolytic Ni/Au

7.12 Quality Requirements

7.12.1 Board material must have a minimum rating of 94V-0 or the highest rating possible based on the laminate material type. The PCB fabrication process and materials shall be recognized by U.L., SELLER shall provide their U.L. File number on the Certificate of Conformance with each shipment.

7.12.2 Ionic Cleanliness, PCB's shall be measured prior to solder mask coating application in accordance with IPC-TM-650, Method 2.3.25, Resistance of Solvent Extract Method. The ionic contaminant level shall not be greater than 1.25 µg/cm^2 of sodium chloride.

7.12.3 Boards must meet the solderability requirements when tested in accordance with the J-STD-003 and appropriate Test Methods and Quality Clause **Solderability & Testing** (NT104, latest revision). Results must be submitted for each date code supplied to BUYER along with the Certificate of Compliance. BUYER reserves the right to reject the entire date code of boards when samples cannot meet this criterion.

7.12.4 Plating thickness and hole wall integrity shall be verified in the smallest thru via and the smallest blind/buried via per Methods IPC-TM-650 2.1.1 for micro-section preparation and IPC-TM-650 2.6.8 for thermal stressing.

7.12.5 Board must be manufactured in accordance with the first article. No changes to the manufacturing location, chemistry, or material used in the deliverable PCB, including Subcontractors, shall be made without prior written authorization from BUYER.

8.0 DELIVERABLES AND SHIPPING DOCUMENTS

8.1 Certificate of Conformance: A Certificate of Conformance (CofC) is required with each shipment. Certificate of Conformance shall contain a statement certifying all requirement have been meet and any

additional information invoked by subsequent Quality Clauses or this specification conform to the set forth specifications. Certificate of Conformance shall be signed by an authorized representative of the manufacturing organization. In conjunction with Quality Clause **First Article Inspection (FAI) Report** (NT104, Latest revision) Certificate of Conformance shall include at a minimum:

- SELLER/Manufacturer Name
- Neo Tech Purchase Order #
- Neo Tech Part Number and revision
- Shipment Quantity
- Supplier Lot Code (work order #)
- Date Code
- Manufacturer UL File #

8.2 **First Article Inspection Report:** When applicable, the First Article inspection report shall be in accordance with Quality Clause **First Article Inspection (FAI) Report** (NT104, latest revision).

8.3 **Microsection Report:** Microsection report shall include measurements in accordance with the applicable specification and IPC standards.

8.3.1 Micro-section potted coupon/s from report and the PCB it was taken from shall be included with the shipment.

8.4 **Electrical Test Report:** Report shall demonstrate 100% Electrical Testing, quantity tested, quantity pass, and test parameters in accordance with IPC-9252.

8.4.1 **Impedance Test Data:** When Impedance Testing is required, Impedance test data shall be provided with each lot.

8.5 **Solderability Data:** Solderability results in accordance with Quality Clause **Solderability & Testing** (NT104, latest revision) must be submitted for each date code supplied to BUYER along with the Certificate of Compliance.

8.6 **Ionic Cleanliness Data:** Ionic contamination report shall be included with each shipment and demonstrate conformance to procurement documentation.

8.7 **Solder Sample:** SELLER shall provide a bare, unsoldered sample PCB array for Solderability and thermal profile with each date code of parts shipped. Solder Sample may be a scrap array and not electrically functional. Sample shall be clearly marked and identified as a Solder Sample.

8.8 **REACH/RoHS:** When PCB procurement is specified on procurement documentation as REACH or RoHS compliant, a statement of compliance shall be provided.

8.9 **Manufacturing Origin:** All PCB procurements, including Brokers, Intermediate Organizations, Manufacturers Reps or Agents shall provide the manufacturer's name and facility location on the Certificate of Conformance with each shipment to BUYER

9.0 PACKAGING REQUIREMENTS

9.1 Shipping boxes not to exceed 25 pounds.

9.2 Shipping carton to be marked with SELLER name, date codes, vendor lot number, purchase order number, quantity in the carton, part number and revision number or per Bar Code Standards requested. If more than one date code is to be shipped in a box, they must be clearly identified on the packages.

9.3 All PCB shall be dry, cleaned and free of debris prior to packaging. In conjunction with Quality Clause **Packaging Requirements** (NT104, latest revision), the packaging shall be done in a way to prevent damage to the product edges / corners using industry acceptable methods (Reference IPC Spec 1601) and must include the following:

- Vacuum Sealed Moisture Barrier Packaging
- Humidity Indicator Card (HIC)
- Desiccant compatible with PCB and Surface Finish
- Slip sheets between each PCB (optional)
- Suitable bubble wrap

9.4 Solder Samples and cross section samples should be packaged separately at the top of the box.

9.5 X-outs, when permitted, shall be packaged separately from no X-out arrays and clearly marked.

9.6 When multiple separate packages are delivered as part of a shipment or an order fulfillment of a single fab PN, each bag shall contain single lot date code and be clearly marked/labeled with the following content information.

- Part Number
- PO Number
- Quantity per bag/container
- Date code(s) in bag/container

9.7 All Immersion Silver finish PCBs must be packed with silver saver paper in between each PCB.